Giovanni Data Portals and Resources Support Student Problem-Based Learning for Climate Change Education

James G. Acker
NASA Goddard Earth Sciences Data and Information Services Center
Greenbelt, MD / Adnet, Inc.

Daniel Zalles
SRI International, Inc.
Menlo Park, CA

Ruth Krumhansl
Education Development Center
Waltham, MA

ABSTRACT

The Data-Enhanced Investigations for Climate Change Education (DICCE) project, funded by NASA, is providing dedicated climate data portals in the NASA Giovanni data system for the use of teachers and students. The central content of the DICCE-Giovanni data portals is a reduced set of climate-relevant data parameters drawn from the available Giovanni data sets, with accessible meanings, such as surface temperature, precipitation amount, snow cover, phytoplankton chlorophyll concentration, vegetation indices, and aerosol optical depth. Information resources explain the significance of the data to climate research, how to interpret climate data trends, and address uncertainties in both data visualizations and the interpretation of data plotting output. "How-to" videos and plotting tips facilitate the utilization of the data portals, so that teachers can create problem-based projects based on actual satellite observational data. The use of satellite data in a problem-based framework enhances the relevance and immediacy of the project content to the student, improves their understanding of Earth climate system interrelationships, and also improves pattern recognition, math skills, and interpretation of data representations.

COMPONENTS OF DICCE–GIOVANNI

The NASA Goddard Earth Sciences Data and Information Services Center (GES DISC) hosts the Giovanni data visualization and analysis system, which in turn hosts the current Giovanni data portals for the DICCE Project. There are currently two DICCE data portals:

➤ DICCE-Giovanni Basic Climate (Monthly) Data
- classed as **Ocean, Atmosphere, Energy, and Land** data types
➤ DICCE-Giovanni Daily Data
- with daily temporal resolution data products from the **MODIS, AIRS, OMI, and TRMM instruments*** of NASA Earth-observing missions

The GES DISC also hosts related informational content to support the data products and available analysis options in the Giovanni system. This content is found on the **DICCE Resources Page** and includes:

➤ DICCE-Giovanni Extended Help

➤ Climate Data Regional Trend Guides

➤ DICCE-Giovanni Plotting Tips

➤ DICCE-Giovanni Troubleshooting Guide

➤ DICCE-Giovanni Instructional Videos

In the current third year of the project, as DICCE teachers are utilizing these resources to create instructional projects on climate change, these informational resources will be enhanced with additional videos, demonstrating plotting tips and providing more examples of how to use the data analysis options to investigate climate change topics using Earth observational data from NASA missions and climate/weather models.

The DICCE-Giovanni (DICCE-G) components are illustrated in the next panels of this poster, followed by an example of how a climate change problem can be constructed and addressed with the DICCE-Giovanni components.

* MODIS – Moderate Resolution Imaging Spectro-radiometer

AIRS – Atmospheric Infrared Sounder

OMI – Ozone Measuring Instrument

TRMM – Tropical Rainfall Measuring Mission

DICCE-G BASIC CLIMATE DATA PORTAL
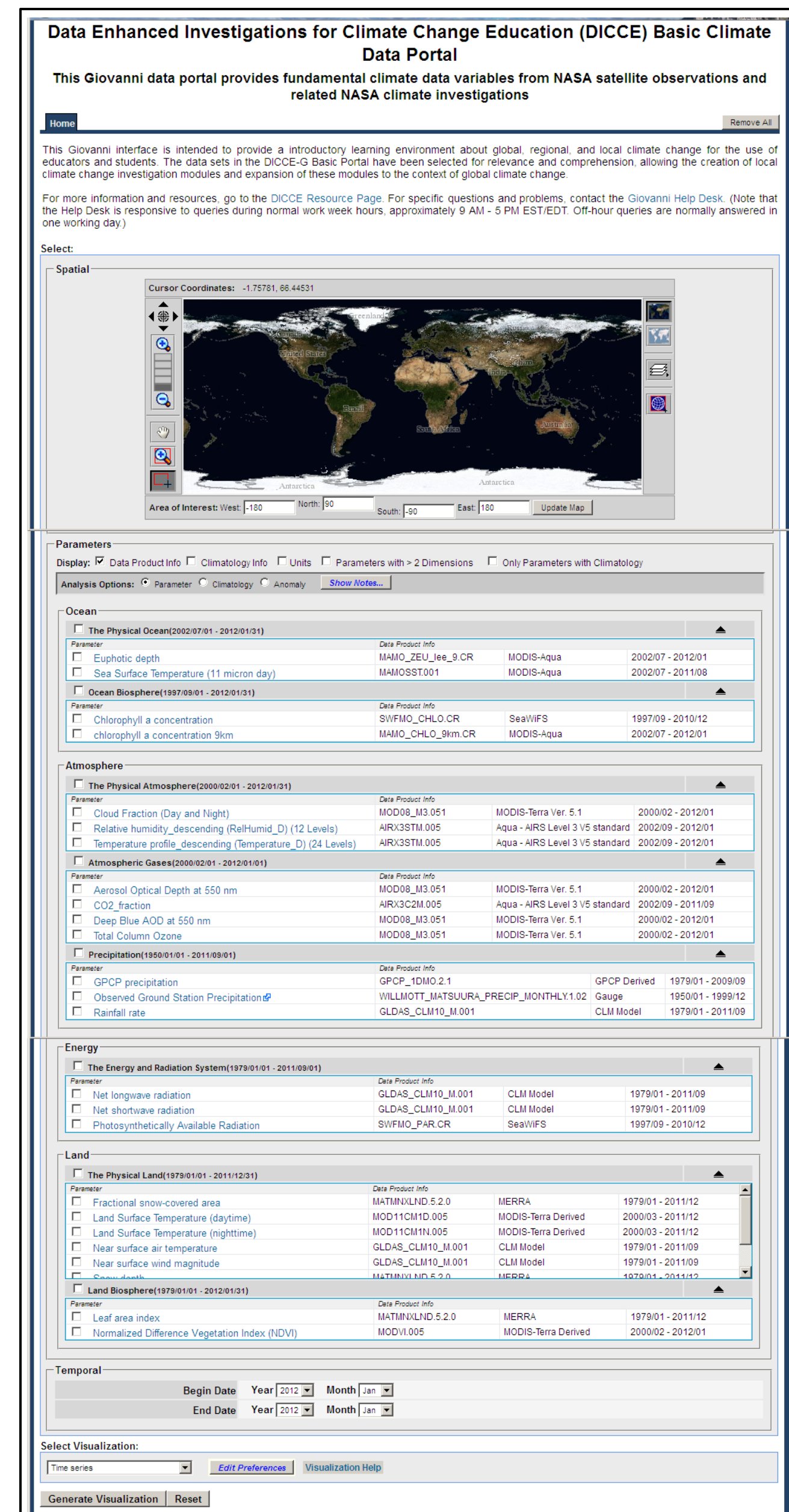
Region-of-interest selection

Data parameter selection

Each data parameter is linked to an entry in the **DICCE-G Extended Help**.

Time period selection

Data visualization selection

DICCE–G CLIMATE DATA TREND GUIDES

This page of the **Atmospheric Gases Trend Guide** discusses how to interpret increasing and decreasing trends of Aerosol Optical Depth. DICCE resources emphasize the importance of examining data trends over time to detect and quantify climate change.

DICCE–G INSTRUCTIONAL "HOW–TO" VIDEOS

Version 2.0 of the DICCE-G Instructional Videos consists of narrated Animated slide presentations demonstrating basic Giovanni operations. Plotting tip videos and screen capture videos of actual Giovanni analyses will be added to the library this year.


Slide from the upcoming Plotting Tip video, "Using the Y-axis adjustment to compare time series"
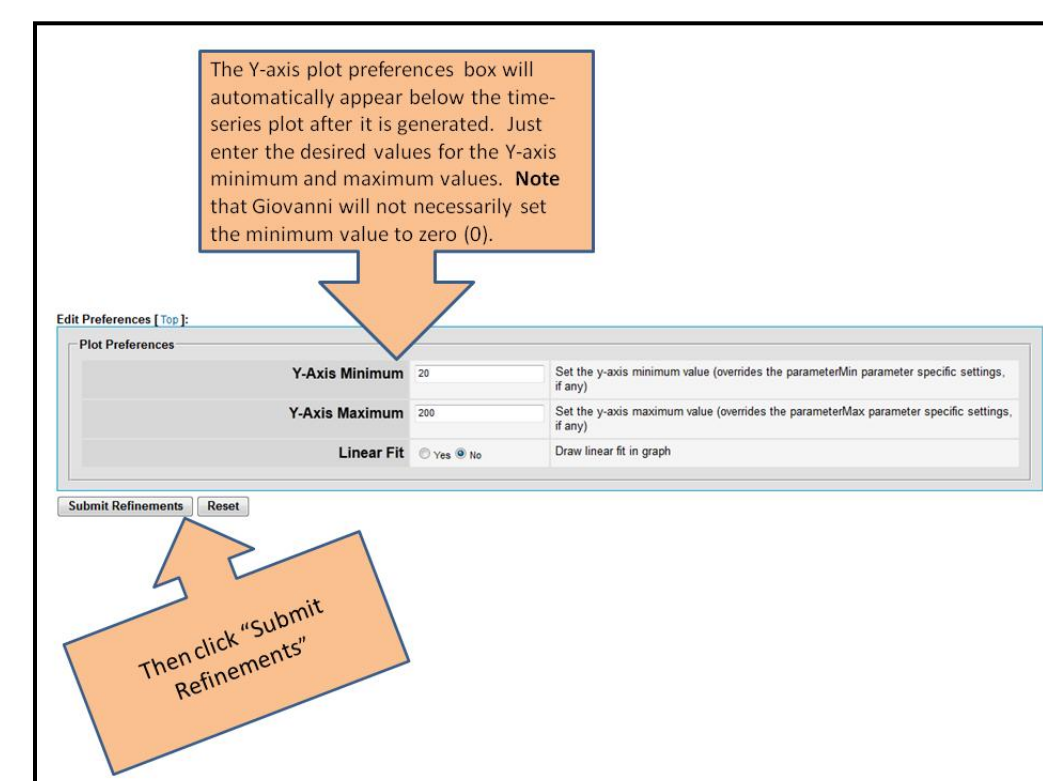
WATER RESOURCES & SNOW TRENDS IN NEW MEXICO: USING DICCE–GIOVANNI FOR PROBLEM–BASED LEARNING

Snow pack conditions in the northern mountains of New Mexico are of continuing concern, due to the fact that much of the state depends on runoff from the snow pack to provide water for populated areas to the south for both agriculture and public use. Over the past few years, persistent drought conditions have reduced the snow pack in these northern mountains.

One potential contributing factor may be lower sea surface temperatures (SST) observed in the Pacific Ocean off of southern California, Baja California, and the Gulf of California. Moisture from the ocean is transported inland via the monsoonal flow to provide both rain and snow to New Mexico. Cooler winter SSTs lead to less ocean water evaporation and weaker storm systems.

New Mexico study region

Pacific Ocean study region
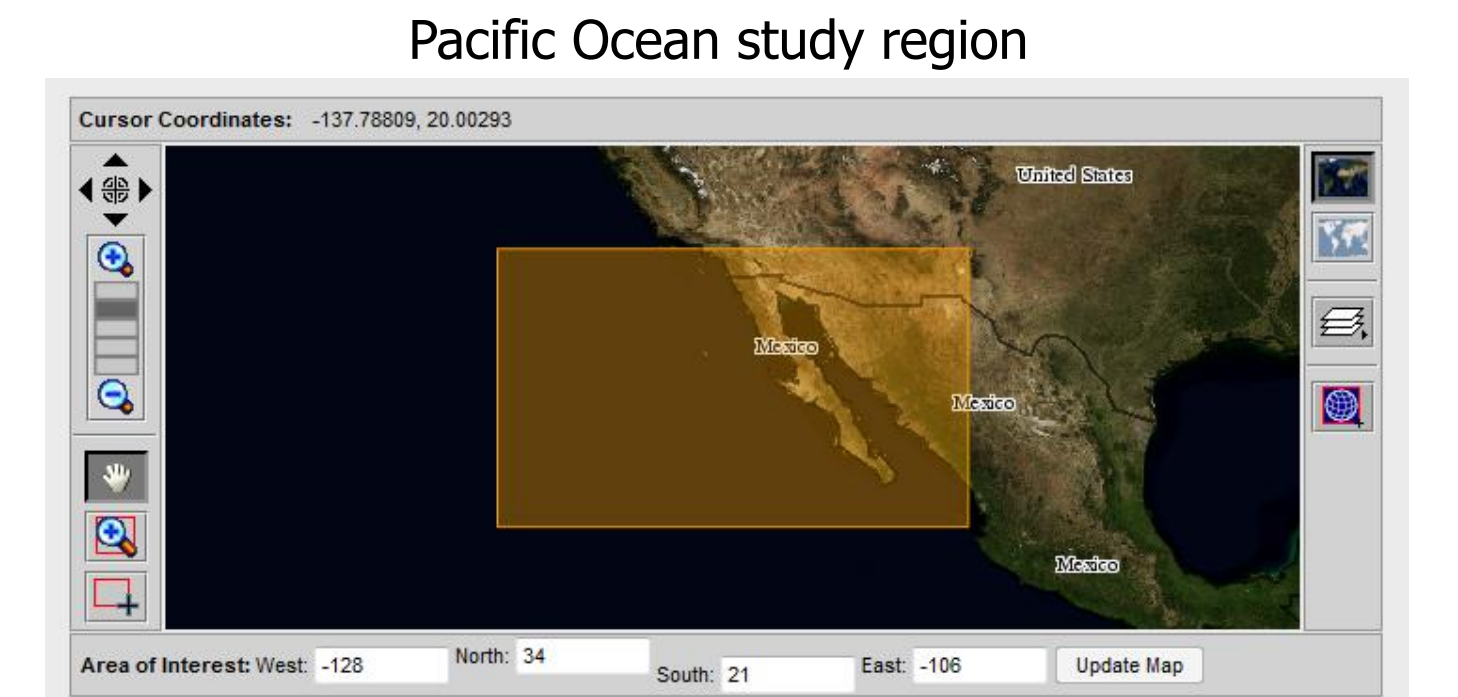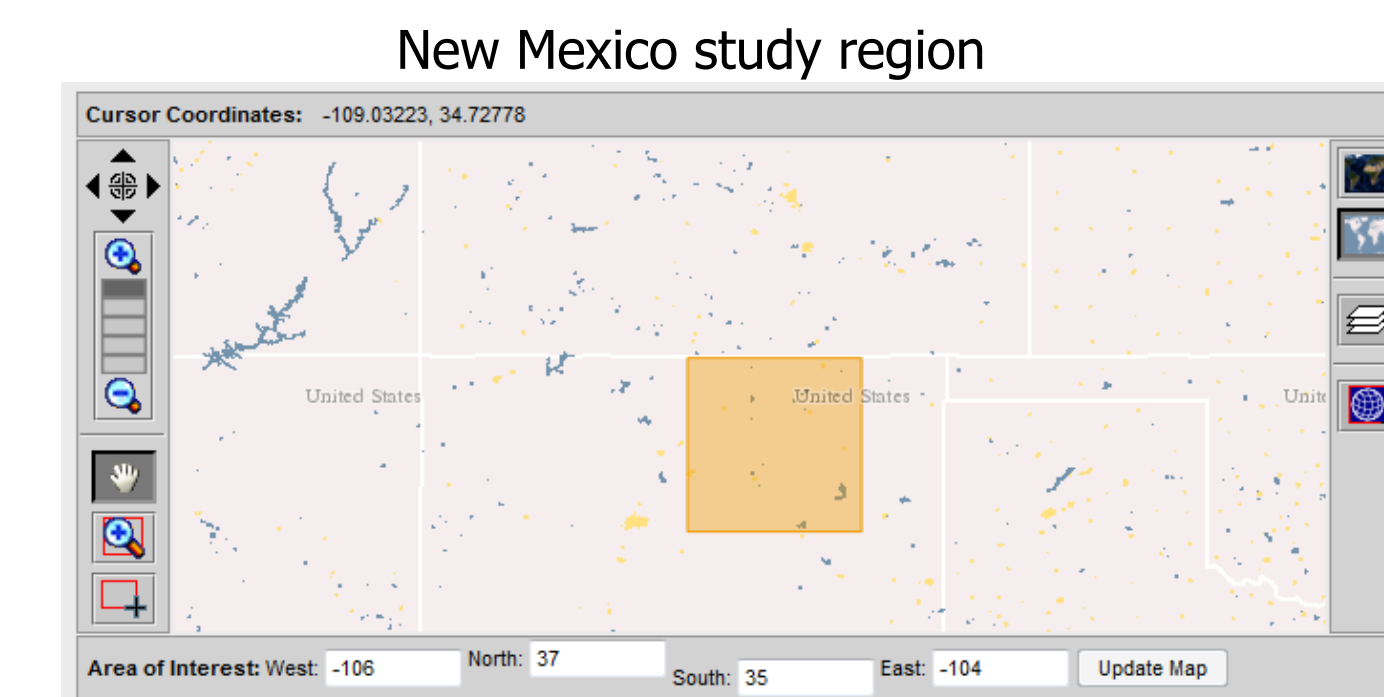
Two data products from the Modern Era Retrospective-analysis for Research and Applications (MERRA) project, fractional snow cover and snow mass, indicate a trend of reduced snow pack in this region of the New Mexico mountains.

Fractional snow cover

Snow mass
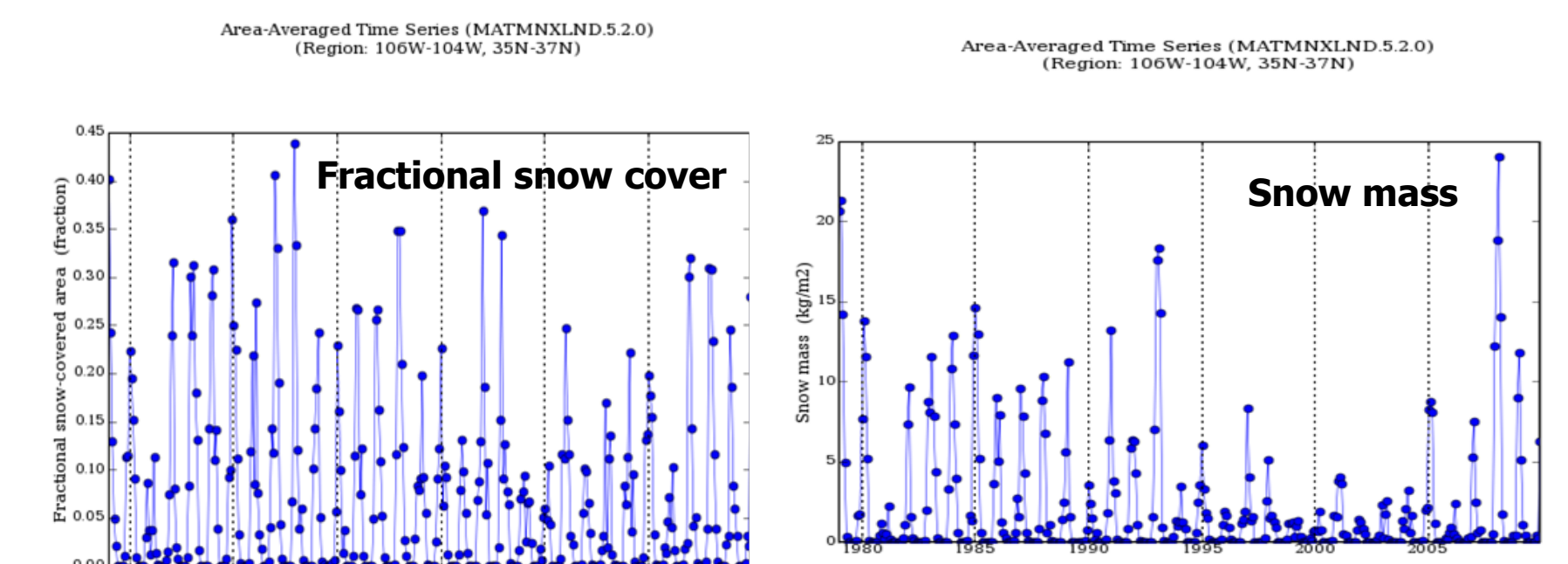
MODIS-Aqua SSTs for the Pacific Ocean southwest of New Mexico indicate a declining trend of winter SSTs over the past nine years.

Sea surface temperature
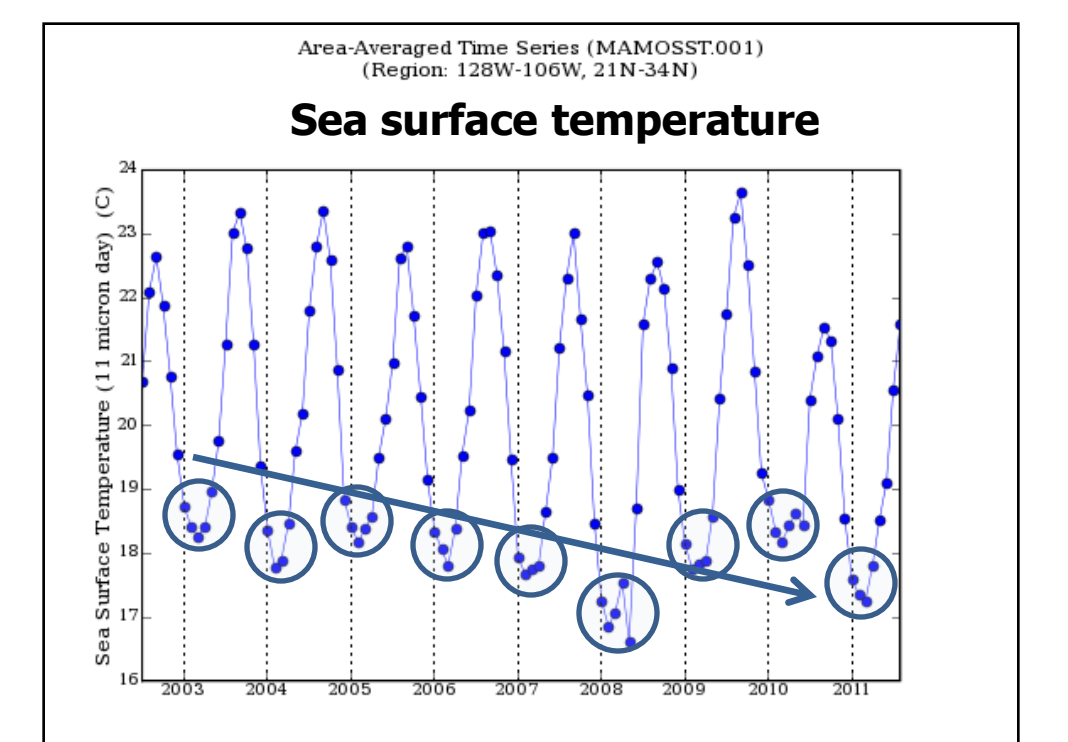
These data thus provide an answerable problem relating potential cause-and-effect observations in the Earth's climate system. This particular problem could be used to introduce many different climate concepts, including the water cycle, El Niño-, La Niña, atmospheric circulation, and the importance of the cryosphere; or to test understanding of these concepts.

After creating the visualizations with DICCE-G, teachers can then utilize the DICCE Learning Environment (described in other presentations at this meeting) to create problem-based learning projects for classroom instruction.

Advanced students or classes could also be invited to utilize DICCE-G resources to address climate change problems in an investigative learning mode.

Giovanni
The Bridge Between Data and Science
NASA GSFC
Goddard Earth Sciences Data and Information Services Center (GES DISC)